

WE CLAIM:

1. An osmotic delivery system plug for controlling a delivery rate of a beneficial agent in an osmotic delivery system, the plug comprising:

a semipermeable body having:

a recess having an interior surface beginning at an opening in the body  
5 and ending at a depth surface within the semipermeable body;

a liquid contact surface located opposite the depth surface;

an outer surface located opposite the interior surface, the outer surface  
having means for sealing an environment of use from an inside of an enclosure  
of an osmotic delivery system in which the body is insertable;

10 a predetermined plug thickness defined by the location of the depth  
surface relative to the liquid contact surface; and

a predetermined wall width defined by the location of the outer surface  
relative to the interior surface, at least one of the predetermined plug thickness  
and predetermined wall width for controlling a rate of liquid permeation through  
15 the semipermeable body.

2. The osmotic delivery system plug according to claim 1 further  
comprising an insert located within the recess.

20 3. The osmotic delivery system plug according to claim 2, wherein the  
insert is pervious to liquids.

4. The osmotic delivery system plug according to claim 1, wherein the  
insert includes a top surface adjacent the depth surface of the tubular interior.

25 5. The osmotic delivery system plug according to claim 1, wherein the  
insert includes a peripheral surface mating the interior surface of the recess.

6. The osmotic delivery system plug according to claim 1, wherein the liquid contact surface of the semipermeable body includes a cone-shaped surface.

7. An osmotic delivery system plug for controlling a delivery rate of a beneficial agent in an osmotic delivery system comprising:  
a semipermeable body at least partially positionable in an opening in an enclosure of an osmotic delivery system, the semipermeable body including a hollow interior portion having a size selected to obtain a predetermined liquid permeation rate through the semipermeable body, the liquid permeation rate for controlling a delivery rate of a beneficial agent in an osmotic delivery system.

8. The osmotic delivery system plug according to claim 7, wherein the hollow interior portion is conical.

9. The osmotic delivery system plug according to claim 7, wherein the hollow interior portion is cylindrical.

10. The osmotic delivery system plug according to claim 7, wherein the semipermeable body includes a liquid contact surface for contacting a liquid external of the osmotic delivery system.

11. The osmotic delivery system plug according to claim 10, wherein the liquid contact surface is located at an end of said body opposite the hollow interior portion.

12. The osmotic delivery system plug according to claim 11, wherein the hollow interior portion includes a depth surface defining a plug thickness of the semipermeable body between the liquid contact surface and the depth surface.

13. The osmotic delivery system plug according to claim 10, wherein the liquid contact surface is cone-shaped.

14. The osmotic delivery system plug according to claim 7, including an insert located within the hollow interior portion.

5 15. The osmotic delivery system plug according to claim 14, wherein the hollow interior portion and the insert are cylindrical, the cylindrical hollow interior portion matingly receiving the cylindrical insert.

10 16. The osmotic delivery system plug according to claim 14, wherein the insert is pervious to liquids.

17. The osmotic delivery system plug according to claim 14, wherein the insert is a semipermeable material having a different permeability than that of the semipermeable body.

15 18. The osmotic delivery system plug according to Claim 14, wherein the insert includes an osmotic agent.

20 19. The osmotic delivery system plug according to claim 7, wherein the semipermeable body includes an outer sealing surface for effecting a seal with the enclosure when the body is at least partially positioned in the enclosure.

25 20. The osmotic delivery system plug according to claim 19, wherein the hollow interior portion includes an interior surface defining a wall width between the outer sealing surface and the interior surface.

21. The osmotic delivery system plug according to claim 19, including a liquid pervious member located within the hollow interior portion for assisting in effecting the seal.

22. The osmotic delivery system plug according to claim 19, wherein the outer sealing surface includes at least one rib.

23. An osmotic delivery system comprising:

an enclosure having an opening and a delivery port, said enclosure having an interior holding a liquid swellable osmotic agent and a beneficial agent, said liquid swellable osmotic agent for imbibing liquid from a surrounding environment and causing a delivery rate of said beneficial agent from said enclosure;

a plug having a semipermeable body at least partially positioned in the opening, the semipermeable body including a hollow interior portion having a size selected to obtain a predetermined liquid permeation rate through the semipermeable body, the liquid permeation rate for controlling the delivery rate of the beneficial agent in the osmotic delivery system.

24. The osmotic delivery system according to claim 23, further comprising a separating member positioned in the enclosure between the osmotic agent and the beneficial agent.

25. The osmotic delivery system according to claim 24, wherein the separating member is a movable piston.

26. The osmotic delivery system according to claim 23, wherein the osmotic agent is a tablet.

27. The osmotic delivery system according to claim 23, wherein the plug includes an insert located in the hollow interior portion.

28. The osmotic delivery system according to claim 23, wherein the enclosure is substantially impermeable to liquids.

29. The osmotic delivery system according to claim 23, wherein the semipermeable body includes a cone-shaped surface.

30. A method of controlling a delivery rate of a beneficial agent from an osmotic drug delivery system that includes an enclosure having an interior holding a liquid swellable osmotic agent and a beneficial agent, the osmotic drug delivery system also including a plug having a semipermeable body at least partially positioned in an opening of an enclosure, the semipermeable body including a hollow interior portion, the method comprising the steps of:

determining a desired delivery rate of the beneficial agent;  
selecting a plug with a hollow interior portion sized to obtain a predetermined liquid permeation rate through the semipermeable body corresponding to the desired delivery rate of the beneficial agent;  
positioning the plug at least partially within the opening of the enclosure;  
and  
locating the osmotic drug delivery system in an environment of use.

31. The method according to claim 30, further including the step of locating an insert within the hollow interior portion.

32. A method of changing a liquid permeation rate through a semipermeable body of an osmotic delivery system to increase a delivery rate of a beneficial agent from the osmotic delivery system, the method comprising the steps of:

making a semipermeable body having a liquid permeability coefficient and a thickness; and  
changing said thickness of said semipermeable body to alter a liquid permeation rate through said semipermeable body.

33. The method according to Claim 32, wherein said semipermeable body is located in an opening of the osmotic delivery system.

34. The method according to Claim 32, wherein said thickness of said semipermeable body is changed by cutting said semipermeable body.

35. The method according to Claim 32, wherein said thickness is changed  
5 after said semipermeable body has been inserted into an opening of the osmotic delivery system.

36. The method according to Claim 32, wherein a liquid impermeable sleeve surrounds a cylindrical surface of said semipermeable body, further comprising the step  
10 of changing a length of said liquid impermeable sleeve.

37. The method according to Claim 36, wherein said length of said semipermeable sleeve is changed when said thickness of said semipermeable body is changed.  
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38. The method according to Claim 32, wherein said semipermeable body is located at least partially within an enclosure of said osmotic delivery system and an enclosure length of said enclosure is changed when said thickness of said semipermeable body is changed.  
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39. A method of varying a liquid permeation rate through a semipermeable body of an osmotic delivery system in which a liquid impermeable sleeve is mounted on the semipermeable body to vary a delivery rate of a beneficial agent from said osmotic delivery system, the method comprising the step of moving said liquid impermeable  
25 sleeve along an exterior surface of said semipermeable body to vary an amount of surface area of said exterior surface that is immediately exposed to liquids when said osmotic delivery system is located in a liquid environment of use.

40. The method according to Claim 39, wherein said semipermeable body is  
30 at least partially located within an enclosure of said osmotic delivery system, and said exterior surface is a cylindrical surface of said semipermeable body.

41. The method according to Claim 39, wherein said liquid impermeable sleeve is moved along an enclosure exterior surface of an enclosure of said osmotic delivery system when said liquid impermeable sleeve is moved along said exterior surface of said semipermeable body.

42. A method of varying a liquid permeation rate through a semipermeable body of an osmotic delivery system to vary a delivery rate of a beneficial agent from the osmotic delivery system, the method comprising the step of:

selecting a desired liquid permeation rate through the semipermeable body of the osmotic delivery system; and

providing a plurality of semipermeable body elements in abutting relation to one another to define said semipermeable body and to achieve said selected liquid permeation rate.

43. The method according to Claim 42, further comprising the step of adding an additional semipermeable body element in abutting relation to said plurality of said semipermeable body elements to achieve another liquid permeation rate different than said selected liquid permeation rate.

44. The method according to Claim 42, further comprising the step of removing at least one of said semipermeable body elements from said plurality of said semipermeable body elements to achieve another liquid permeation rate different than said selected liquid permeation rate.

45. The method according to Claim 42, wherein said plurality of semipermeable body elements are attached to each other with an adhesive.

46. An osmotic delivery system comprising:

a liquid impermeable enclosure having an interior holding a beneficial agent and an osmotic agent for imbibing liquid from a surrounding environment and causing delivery of said beneficial agent from said liquid impermeable enclosure;

a semipermeable body in liquid communication with said liquid impermeable enclosure for permitting liquid to permeate through said semipermeable body to said osmotic agent;

a liquid impermeable sleeve separate from said liquid impermeable enclosure and surrounding a portion of a surface of said semipermeable body such that said portion of said surface is not immediately exposed to liquid when said osmotic delivery system is located in a liquid environment of use and such that said semipermeable body includes an exposure surface defined by an area of said surface that is not surrounded by said liquid impermeable sleeve and is immediately exposed to liquids when said osmotic delivery system is located in the liquid environment of use.

47. The osmotic delivery system according to Claim 46, wherein said portion of said surface of said semipermeable body is a cylindrical surface and said liquid impermeable sleeve abuts against said cylindrical surface.

48. The osmotic delivery system according to Claim 47, wherein the exposure surface of said semipermeable body includes a surface incident to said cylindrical surface.

49. The osmotic delivery system according to Claim 46, wherein said liquid impermeable sleeve abuts said surface of said semipermeable body and is movable with respect to said surface to vary an amount of said exposure surface that is exposed to liquid when said osmotic delivery system is placed in the liquid environment of use.

50. The osmotic delivery system according to Claim 46, wherein said liquid impermeable sleeve abuts against an exterior surface of said liquid impermeable enclosure and is movable with respect to said exterior surface of said liquid impermeable enclosure.



51. The osmotic delivery system according to Claim 46, wherein the semipermeable body is positioned within an opening of said liquid impermeable enclosure of said osmotic delivery system.

52. The osmotic delivery system according to Claim 46, wherein at least one of said liquid impermeable sleeve and said enclosure includes threads such that said liquid impermeable sleeve is movable linearly with respect to said enclosure by rotating said sleeve.

53. An osmotic delivery system comprising:  
an enclosure having an interior holding a beneficial agent and an osmotic agent, said osmotic agent for imbibing liquid from a surrounding environment and causing delivery of said beneficial agent from said enclosure;

a first semipermeable body in liquid communication with said enclosure for permitting liquid to permeate through said first semipermeable body to said osmotic agent; and

a second semipermeable body abutting said first semipermeable body and in liquid communication with said first semipermeable body so as to permit liquid to permeate through said first semipermeable body and said second semipermeable body to said osmotic agent.

54. The osmotic delivery system according to Claim 53, wherein said second semipermeable body is removable from said first semipermeable body to vary a liquid permeation rate into said osmotic delivery system.

55. The osmotic delivery system according to Claim 53, wherein said second semipermeable body is attached to said first semipermeable body by an adhesive.

56. The osmotic delivery system according to Claim 53, wherein said first semipermeable body and said second semipermeable body are semipermeable layers.

57. An osmotic delivery system comprising:

an enclosure having an opening and a delivery port, said enclosure having an interior holding a liquid swellable osmotic agent and a beneficial agent, said  
5 liquid swellable osmotic agent for imbibing liquid from a surrounding environment and causing a delivery rate of said beneficial agent from said enclosure; and

a plug having a semipermeable body, the plug being at least partially positioned in the opening, the semipermeable body having an exposure surface that is immediately exposed to liquids when the osmotic delivery system is located in a liquid  
10 environment of use, said exposure surface including a conical surface.

58. The osmotic delivery system according to claim 57, wherein the semipermeable body includes a cylindrical portion.

59. The osmotic delivery system according to claim 57, wherein a vertex of the conical surface faces away from the osmotic agent.

60. The osmotic delivery system according to claim 57, wherein the semipermeable body includes ribs for effecting a seal between the enclosure and the  
20 semipermeable body.

61. The osmotic delivery system according to claim 57, the semipermeable body including a hollow interior portion having a size selected to obtain a predetermined liquid permeation rate through the semipermeable body, the liquid  
25 permeation rate for controlling the delivery rate of the beneficial agent in the osmotic delivery system.

62. The osmotic delivery system according to claim 61, further comprising a porous insert located in the hollow interior portion.